SAMPLING AND ANALYSIS WORKPLAN
UDOT LANDFILL
6200 SOUTH 3200 WEST
TAYLORSVILLE, UTAH

December 10, 2002

Prepared for:

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6200 SOUTH 3200 WEST
TAYLORSVILLE, UTAH

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1. INTRODUCTION

1.1 LOCATION AND DESCRIPTION

The Utah Department of Transportation (UDOT) owns an approximate 126-acre vacant property in Taylorsville, Utah. This property is bounded on the east by 3200 West Street, on the south by 6200 South Street, on the west by Bangerter Highway and a residential neighborhood, and on the north by residential properties (see Figure 1). The southeast portion of this property was used to mine gravel and was subsequently backfilled with municipal waste and construction/demolition debris. The portion that received waste covers approximately 30 acres, as shown in Figure 2. UDOT wishes to consolidate the municipal waste into a smaller footprint (6 acres) and transfer the landfill property, along with adjacent property to total 22 acres, to the City of Taylorsville to be used as a park. The remainder of the 126-acre property will then be sold by UDOT for development of commercial and residential property.

The site is located along the eastern flank of the Oquirrh Mountains, on the western edge of the Salt Lake Valley. The UDOT parcel is underlain by interbedded lacustrine clays, sands, silts, and gravels that were deposited near the western edge of historic Lake Bonneville. The site was mined for these gravels for approximately 40 years, from the 1960s to the late 1990s. After mining the gravels, the southeast portion of the property was used by Salt Lake County to dispose municipal solid waste and construction debris in the 1960s and 1970s. The landfilling was reportedly discontinued in approximately 1978.

Municipal waste is deposited primarily in three areas: M1, M2, and M3 (see Figure 2). M1 and M3 appear to contain up to 40 feet of municipal waste, while M2 contains about 20 feet of waste. Construction debris is present in three areas: C1, C2, and C3. C1 appears to contain about 25 feet of debris, primarily asphalt and concrete rubble. C2 reportedly contains about 4 feet of debris, and C3 appears to have received only a few feet of material. The waste cells are generally

covered by 2 to 3 feet of soil, but debris is visible on the surface of the waste cells as well as on the ground surface in some areas across the site.

1.2 INVESTIGATION OBJECTIVES

Due to the presence of municipal wastes and construction debris on the site, Salt Lake Valley Health Department (SLVHD) has expressed concern that metals may have leached from waste material into the native soils below. These native soils will be exposed once waste materials are moved and consolidated in the southeast corner of the site. The objective of this investigation is to assess whether surface soils, which will be freshly exposed once the existing waste materials are moved, are impacted with pollutant metals above local background concentrations.

This Sampling and Analysis Plan (SAP) establishes the guidelines for collecting representative background soil samples in the site vicinity and surface soil samples at the UDOT Landfill. Soil will be sampled and analyzed to document constituents of concern. The sampling program is designed to fulfill the data requirements, including:

- The samples collected must be representative of the materials sampled;
- Sample integrity must be maintained and documented;
- Proper measurements and information must be recorded;
- Sample volumes must be sufficient for the required analytical procedures; and
- Analytical results adequately characterize soil.

2. PROPOSED SAMPLE LOCATIONS AND TYPES

2.1 SAMPLING RATIONALE

Potential migration of metals from the landfill materials are primarily expected to have affected the soils immediately below the wastes. The solubility and mobility of these metals are relatively low, so vertical migration of these contaminants is likely limited. Therefore, samples will be collected from depths of 0 to 6 inches bgs beneath the footprint of the waste cells to evaluate the zone where the highest metals concentrations are expected. The soil confirmation samples will be collected from the native soils after the waste has been removed.

2.2 SAMPLING FREQUENCY

To develop an indication of whether soils across the property have been impacted, samples will be collected in a grid of approximate 100-foot intervals throughout the former landfill area. Therefore, each sample location will represent an area of about 10,000 square feet (ft^2), or 1.7% of the former landfill area. Based on the identified waste footprint, there will be a total of 58 soil confirmation samples.

Additionally, eight soil samples will be collected from the area surrounding the UDOT Landfill. These samples will be collected in areas where no landfilling has occurred and will be used to establish normal background conditions for the area. The proposed statistical method for calculating background is discussed in Section 6.

2.3 PROPOSED SAMPLE LOCATIONS

The confirmation soil samples will be collected on an approximate 100-foot grid as shown on Figure 3. Each sample location will be staked and labeled in the field. At each sample location, coordinates will be measured with a hand-held Global Position System (GPS) unit. GPS survey accuracy will be approximately 10 to 15 feet horizontal and 7 feet vertical. Stakes will be maintained at the site for exact reference until the project is complete.

In addition to the proposed sample locations, grab samples may be collected at the field sampler's discretion if observations indicate a potential target area (e.g., localized low spots, discolored areas) where impacts could be greater. Grab sample locations will also be staked and surveyed with the GPS unit.

Background samples will be collected at the approximate locations shown on Figure 3. Before collecting a background sample, the sample area will be inspected to confirm no visible evidence of debris on "fill mounds" near the sample site.

Additional confirmation samples will be collected if impacted areas are identified through this proposed sampling and analysis project. Any soil identified that exceeds background concentrations will be excavated and moved to the consolidated landfill area. Secondary confirmation samples will then be collected at the frequency specified in Section 2.2 from the over-excavated area. The secondary confirmation sample locations will be staked and surveyed with the GPS unit.

2.4 SAMPLE TYPES

Each proposed sample will be a composite of five sub-samples collected from the sample location. The five sub-samples will be collected from the staked grid point and from points 10 feet from the stake in each direction (north, south, east, and west). This will increase the sample's representativeness. If additional target samples are collected, these will be grab samples.

2.5 SAMPLE ANALYSIS

Each sample will be analyzed for total concentrations of arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver. Analytical procedures are described in Section 4.

3. SAMPLING PROCEDURES

This section outlines standard operating procedures (SOPs) to be followed in conducting surface soil sampling for quantitative analysis. Samples will be collected from the shallow subsurface (0 to ½ foot bgs) by hand methods. Analytes will include eight pollutant metals (arsenic, barium, cadmium, chromium, lead, mercury, silver, and selenium). Site-specific sampling requirements (i.e., number and locations of samples) are discussed in Section 2.

Sample types may consist of grab or composite samples. A grab sample is a sample collected from a discreet location. This type of sample will only be collected during site characterization if visual observations indicate the presence of an anomalous zone. A composite sample consists of material sampled from two or more sub-locations combined together to form one sample. This type of sample will be collected from areas believed to be homogenous in nature and will be considered representative of the metals concentrations in the sample area. Background and confirmation samples will be collected as composite samples.

The following sections describe specific sampling procedures to be used in the collection process.

3.1 SURFACE SAMPLING

The following procedures will be used to collect a soil sample from the 0 to ½ foot below surface interval:

- Excavate a hole to approximately 8 inches below ground surface using a trowel, hand shovel, or pickhoe;
- Using a clean hand tool, scrape the side of the hole until undisturbed sample material is exposed;

- Place a clean cup or sample jar at the bottom of the desired sample location;

- Using a clean hand tool, scrape sample material from the side of the hole allowing it to fall into the cup. If a composite sample is required, collect equal amounts of sample material from each sub-site;

- Pour the contents of the cup into the appropriate sample container and seal;

- Label the sample container with the following information:

    ◊ Sample identification number;
    ◊ Date and time of collection;
    ◊ Project number; and

- Replace excavated soil into the hole.

3.2 SAMPLING SEQUENCE

The following sequence of events will be followed for all collected soil samples:

1. Collect sample following the procedures listed in Section 3.1;

2. Label container with sample number, date, time, and project number; and

3. Record sample on the field sample log.

4. Document information about the individual samples and conditions on daily field reports, including a map or diagram;

At day end:

5. Prepare chain-of-custody forms; and

6. Package and deliver samples, including chain of custodies, to the analytical laboratory.

3.3 FIELD DOCUMENTATION

Field notes will be maintained by on-site personnel during all sampling activities. The general information recorded for each days' sampling event includes:

- Date;
- Name of overall sampling event and project number;
- Sampling personnel; and
- Climatic conditions;
- Field observations; and
- Map or diagram.

An example form for field notes is included in Appendix A.

For each sample collected, the following information will be recorded on the field sample log:

- Sample number;
- Location (site number) with GPS survey coordinates;
- Time;
- Sampling method (grab, composite, etc.);
- Sample type (composite soil, grab soil, etc.);
- QA (split, etc.); and
- Analyses to be performed.

An example form for the field sample log is included in Appendix A.

Significant deviations from sampling protocol will be formally noted in the field notes, along with visiting personnel and unusual circumstances pertinent to the sampling effort.

3.4 SAMPLING TOOLS

Soil samples will be collected using disposable plastic sample equipment and hand tools. These tools may include one or more of the following:

- Disposable plastic spoon, scraper, trowel, and/or cup;
- Hand shovel;
- Pickhoe; and
- Gloves.

Only disposable plastic tools will contact sampled material. Hand shovels and or pickhoes will be used only to gain access to sample material. Disposable tools will be discarded after each use.

3.5 SAMPLE CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES

Sample containers, preservation techniques, and holding times will be consistent with EPA SW-846 guidelines. Soil samples will be placed in glass bottles. No preservation is necessary for metals analysis and holding time is six months for everything except mercury (mercury is 28 days). Samples will be kept cooled to <4 degrees C. Extraction and analysis will be performed within 28 days after collection. Table 1 contains a list of the container types, preservation methods, and holding times for each analytical procedure.

3.6 CONTAINER LABELS

To prevent misidentification of samples, each sample container will be labeled and written with indelible ink. The following information will be recorded on the sample container:

- Sample identification number;
- Date and time of collection; and
- Project identification number.

3.7 SAMPLE HOMOGENIZATION

Material sampled for metals characterization will be homogenized prior to analysis. This may be done in the field or at the laboratory. Homogenization techniques will vary depending on sample texture and moisture content. Drying may be necessary to facilitate good homogenization.

Homogenization will be accomplished by shaking or stirring the sample in the sample container. Only disposable plastic tools will be used in the homogenization process.

3.8 CHAIN-OF-CUSTODY

Chain-of-custody will be maintained for all samples collected. To establish the documentation necessary to trace sample possession from the time of collection, a chain-of-custody record will be filled out and accompany every set of samples. The record will include the following:

- List of sample numbers;
- Signature of collector;
- Date and time of collection;
- Sample types;
- Number of containers;
- Parameters requested for analysis for each sample;
- Signature of person(s) involved in the chain of possession; and
- Inclusive dates of possession.

A sample chain-of-custody form is included in Appendix A.

3.9 SURVEYING

The approximate proposed sample coordinates are shown on Figure 3 and are listed in Appendix A. Actual sample sites will be surveyed using a hand-held GPS unit. Locations will be reported in UTM Coordinates. Sites will also be referenced to known landmarks if any are in close proximity. Sample sites will be marked in the field with a 1-inch by 2-inch by 18-inch wooden stake labeled with the site number.

4. ANALYTICAL METHODS

The soil samples will be analyzed at American West Analytical Laboratory for pollutant metals according to EPA methods. Analytical procedures will be consistent with Federal Guidance Solid Waste (SW)-846 (Test Methods for Evaluating Solid Waste). Samples will be analyzed for total concentrations of eight metals, as listed in Table 1.

Table 1
Analytical Methods, Container Types,
Preservation Methods, and Holding Times

Constituent	Method	Matrix	Container	Preservative	Holding Time
Total Arsenic	7060A	Soil	4 oz. glass jar	none	6 months
Total Barium	6010	Soil	4 oz. glass jar	none	6 months
Total Cadmium	6010	Soil	4 oz. glass jar	none	6 months
Total Chromium	6010	Soil	4 oz. glass jar	none	6 months
Total Lead	6010	Soil	4 oz. glass jar	none	6 months
Total Mercury	7471A	Soil	4 oz. glass jar	none	28 days
Total Silver	6010	Soil	4 oz. glass jar	none	6 months
Total Selenium	7740	Soil	4 oz. glass jar	none	6 months

5. QUALITY ASSURANCE OBJECTIVES

The purpose of data quality assessment is to assure that data generated under the QA program is accurate and consistent with program objectives. The quality of the data will be assessed based on precision, accuracy, and completeness. Percent precision is the degree to which a measurement is reproducible and will be assessed by a comparison of split sample results. Percent accuracy is a determination of how close the measurement is to the true value and will be assessed via spike recovery in sample matrices. This will be performed by the laboratory as part of their quality assurance/quality control (QA/QC) procedures. Completeness is a measure of the amount of valid data obtained, compared to the amount that was expected under normal conditions. Eighty percent (80%) completeness is the goal of this assessment.

5.1 QA/QC SAMPLES

Only one type of QA/QC sample, the split sample, will be collected.

One out of every 10 samples collected for analysis of metals will be split into two aliquots: a primary sample and a QA duplicate. Primary and QA duplicate samples will be submitted to American West Analytical Laboratories in Salt Lake City, Utah. The analysis of split samples will be compared to assess whether reproducible results are obtained by the laboratory (laboratory precision).

American West Analytical Laboratory is EPA certified and as such follows QA/QC procedures consistent with EPA standards. Laboratory QA/QC samples include method blanks, matrix spikes, matrix spike duplicates, and laboratory control samples. These laboratory QA/QC samples will be used to assess laboratory accuracy.

5.2 DATA REDUCTION AND VALIDATION

All data will be reported in appropriate units. All raw data will be reviewed to ensure that data are reliable and in compliance with QA/QC objectives. The relative percent difference (RPD) of the split samples will be calculated. If the RPDs are consistently greater than 25%, corrective action may be taken, including:

- Reanalyzing the samples, if holding time criteria permit;
- Resampling and reanalyzing;
- Evaluating and amending sampling and analytical procedures;
- Accepting data, acknowledging level of uncertainty; and/or
- Conducting a laboratory audit.

The nature of the corrective action will depend on the circumstances unique to each situation.

6. BACKGROUND CONCENTRATIONS

6.1 ESTABLISHING BACKGROUND CONCENTRATIONS

Eight composite samples will be collected to provide a representative assessment of background metals concentrations in soil in the site vicinity. The average concentration and standard deviation for each metal will be calculated from this sample set. The "normal background range" for each metal will be defined as:

$$\text{Background Concentration Range} = \bar{x} - 3\sigma \text{ to } \bar{x} + 3\sigma$$

Where: $\bar{x}$ = the average concentration
σ = the standard deviation

Therefore, the normal background range for each metal will be the average metal concentration detected plus or minus three standard deviations.

For a normally-distributed sample population, this range will include 99% of the population.

6.2 DEFINING "CLEAN" CLOSURE SAMPLES

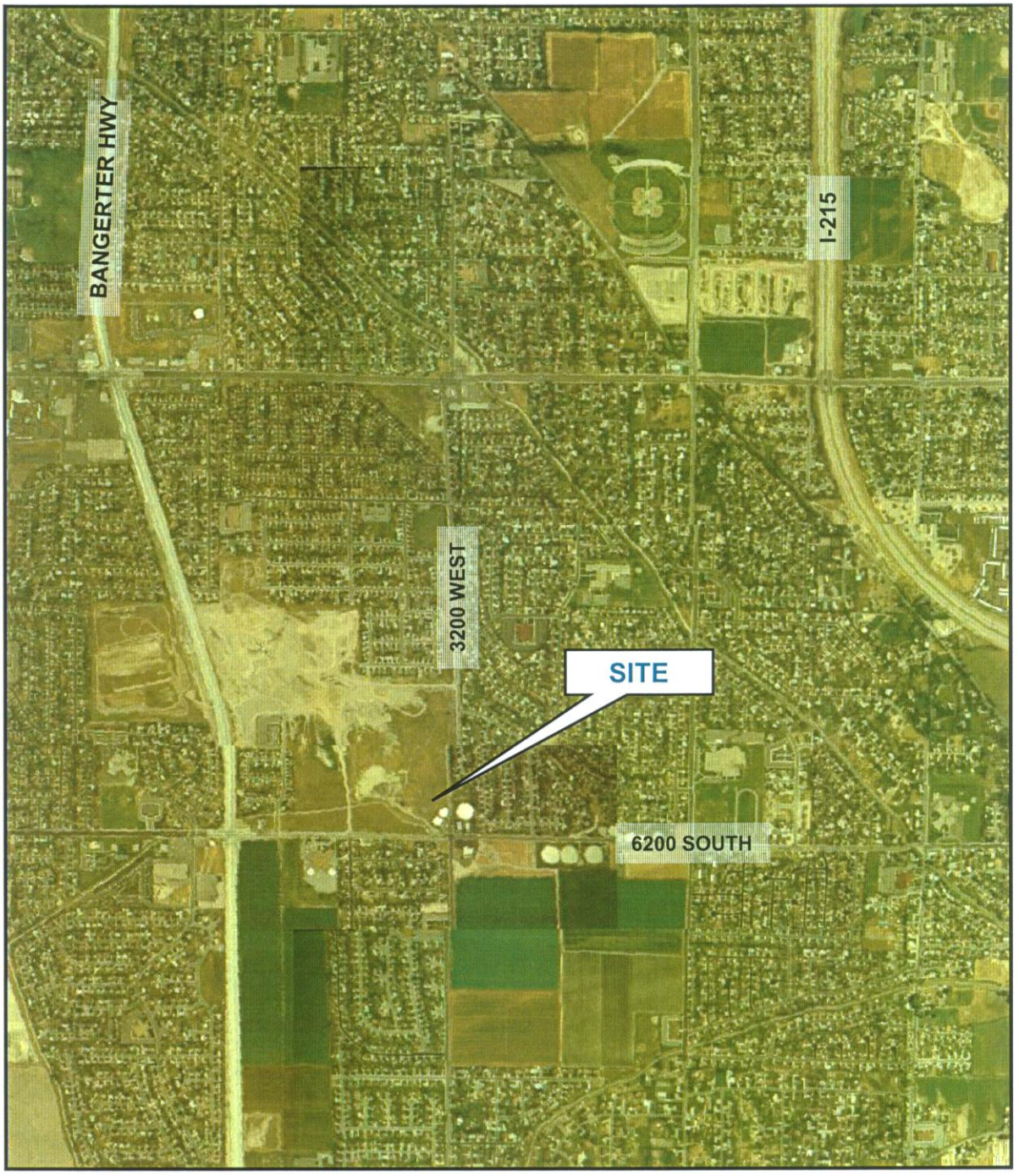
The confirmation soil sample results will be compared to the predetermined normal background range. If the metal concentrations detected do not exceed the established background concentrations, the soil in that area will be considered "clean" with respect to the project goals and no further sampling or excavation will be necessary. If one or more samples exceed background, those areas will be over-excavated a minimum of 6 inches and resampled until confirmation sample results fall below established background concentrations. When all proposed confirmation samples have been demonstrated to meet background concentrations and the new landfill cell has been constructed and determined to meet the construction specifications, including site re-vegetation, the project will be considered complete. At that time, post-closure requirements will apply.

7. SCHEDULE

The background samples will be collected before waste moving and landfill construction begin. When those analytical results are received, the normal background range for each of the eight metals will be determined. A summary will be submitted to Salt Lake Valley Health Department presenting the analytical results and background range calculations.

Confirmation samples will be collected periodically throughout the project as waste is removed. If an area exceeds the established background criteria, that area will be over-excavated and resampled as soon as possible. Therefore, when nearing completion of the waste-transport phase of work, the majority of the site will have been demonstrated to meet the cleanup criteria. The final confirmations samples will be analyzed on a rush basis to facilitate timely project completion.

FIGURES



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Project Number 21770.001

UDOT Property
6200 South 3200 West
Taylorsville, Utah

SITE VICINITY MAP

FIGURE

1

APPROXIMATE AREAS IDENTIFIED BY THE OCT. 1999 BORINGS & 1996 TEST PITS

6200 SOUTH

3200 WEST

M1

M2

M3

C1

C2

C3

B-15A 8'

B-4 15'

B-14 18'

B-1 15'

B-5 15'

B-6 18'

B-7 33'

B-8 32'

B-9 4'

B-10 22'

B-11 37'

B-12A 37'

B-13 41'

0'

APPROXIMATE EXTENT OF SELECT FILL

EXTENT OF PROPOSED LANDFILL BOUNDARIES

SOURCE: EWP ENGINEERING, GRAVEL PIT CONTAMINATION STUDY

SLC2d338.dwg

ESTIMATED VOLUMES/AREAS

(Gravel Pit Contamination Study, EWP, 1999)

AREA	WASTE (CY)	OVERBURDEN (CY)	SURFACE AREA (ACRE)
M1	43,800	16,700	2.4
M2	46,100	23,900	4.4
M3	169,000	26,500	4.6
TOTAL:	258,900	67,100	11.4
C1	19,500		1.3
C2	16,300		2.5
C3	22,000		2.4
TOTAL:	57,800		6.2

N

0 100' 200 400'

Approximate Scale : 1" = 200'

KEY

- M1 — MUNICIPAL SOLID WASTE CELL DESIGNATION
- C1 — CONSTRUCTION DEBRIS CELL DESIGNATION
- B-7 — BORING LOCATION & NO. (OCT. 99) (MSW/CD ENCOUNTERED)
- 8' — DEPTH TO BASE OF MSW/CD
- APPROXIMATE MSW AREAS
- APPROXIMATE CD AREAS
- MONITORING WELL

FIGURE 2

SITE PLAN

UDOT Property
6200 South 3200 West
Taylorsville, Utah

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SLC2d337.dwg

FIGURE 3

SOIL SAMPLE LOCATION MAP

UDOT Property
6200 South 3200 West
Taylorsville, Utah

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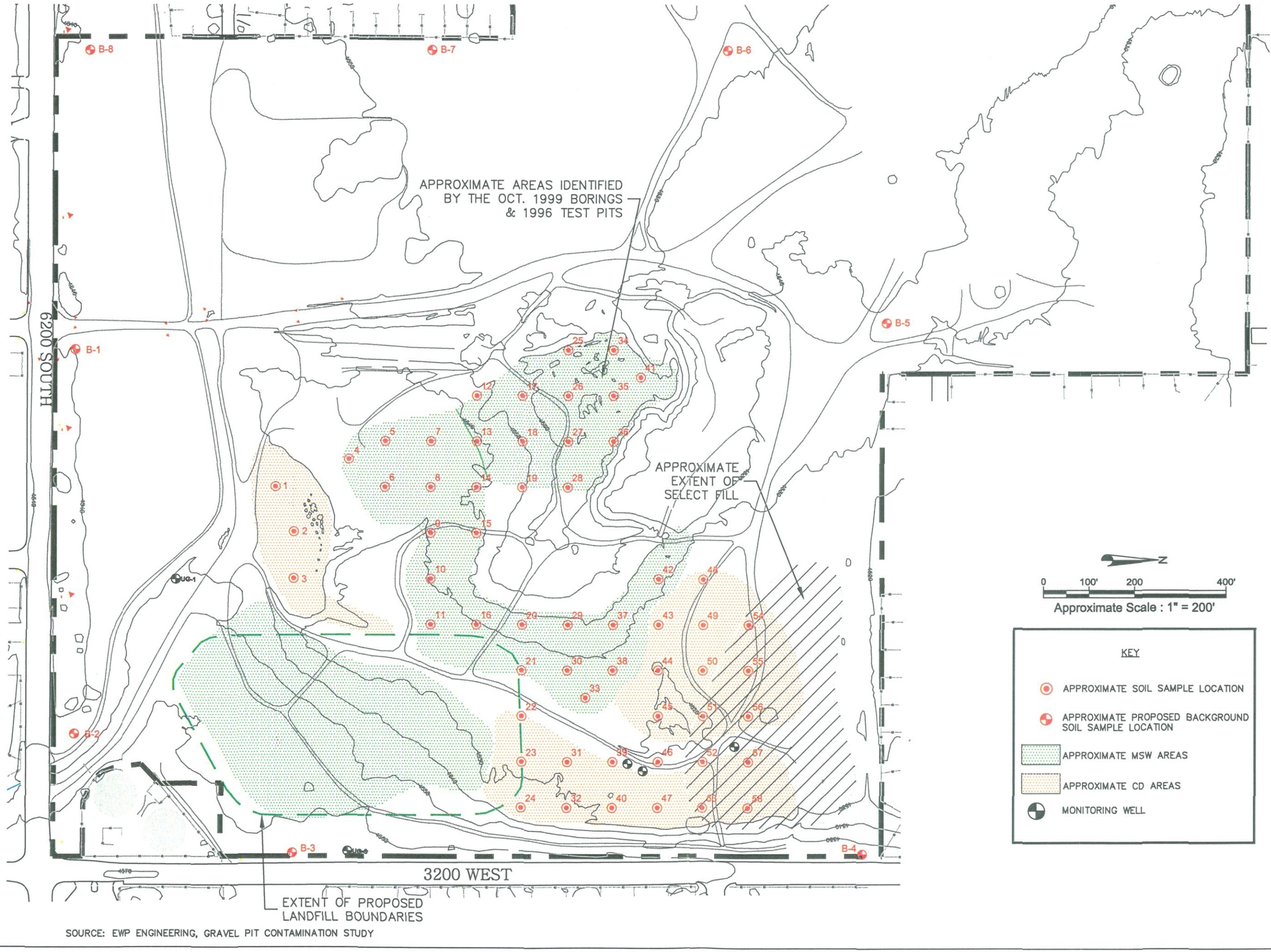
November 2002
Project Number 21770.001



SOURCE: EWP ENGINEERING, GRAVEL PIT CONTAMINATION STUDY

APPENDIX A

APPENDIX A

FIELD DOCUMENTATION—
Sample Forms

Proposed Soil Sample Locations
UDOT Landfill, Taylorsville, Utah

	Feet, Relative to Ref. Point		Site UTM Coordinate (feet)	
	East	North	East	North
Ref. Pt.	0	0		
1	300	160	300	160
2	400	200	400	200
3	500	200	500	200
4	240	320	240	320
5	200	400	200	400
6	300	400	300	400
7	200	500	200	500
8	300	500	300	500
9	400	500	400	500
10	500	500	500	500
11	600	500	600	500
12	100	600	100	600
13	200	600	200	600
14	300	600	300	600
15	400	600	400	600
16	600	600	600	600
17	100	700	100	700
18	200	700	200	700
19	300	700	300	700
20	600	700	600	700
21	700	700	700	700
22	800	700	800	700
23	900	700	900	700
24	1000	700	1000	700
25	0	800	0	800
26	100	800	100	800
27	200	800	200	800
28	300	800	300	800
29	600	800	600	800
30	700	800	700	800
31	900	800	900	800
32	1000	800	1000	800
33	760	840	760	840
34	0	900	0	900
35	100	900	100	900
36	200	900	200	900
37	600	900	600	900
38	700	900	700	900
39	900	900	900	900
40	1000	900	1000	900
41	60	960	60	960
42	500	1000	500	1000
43	600	1000	600	1000
44	700	1000	700	1000
45	800	1000	800	1000
46	~~900~~ 950	1000	900	1000
47	1000	1000	1000	1000
48	500	1100	500	1100
49	600	1100	600	1100
50	700	1100	700	1100
51	800	1100	800	1100
52	900	1100	900	1100
53	1000	1100	1000	1100
54	600	1200	600	1200
55	700	1200	700	1200
56	800	1200	800	1200
57	900	1200	900	1200
58	1000	1200	1000	1200

Proposed Soil Sample Locations
UDOT Landfill, Taylorsville, Utah

	Feet, Relative to Ref. Point		Site UTM Coordinate (feet)	
	East	North	East	North
B1	0	-280	0	-280
B2	840	-280	840	-280
B3	1100	200	1100	200
B4	1100	1450	1100	1450
B5	-60	1500	-60	1500
B6	-650	1150	-650	1150
B7	-650	500	-650	500
B8	-650	-250	-650	-250
T1	Target samples will be collected			
T2	if field observations indicate			
T3	anomalous areas -- Locations to			
T4	be determined as needed.			
C1	Confirmation samples will be			
C2	collected if additional material			
C3	is removed based on the results			
C4	of the original sampling -- Locations			
C5	to be determined as needed.			

KLEINFELDER

KLEINFELDER SAMPLE CONTROL LOG

PROJECT NAME:_____ PROJECT NUMBER:_____ DATES of FIELD WORK:_____

SAMPLE DESCRIPTION				SAMPLE CONTAINER					
DATE	TIME	FIELD SAMPLE NUMBER	SAMPLE LOCATION (East, North)	MATRIX (soil, etc)	# of CONTAINERS	CONTAINER TYPE	PRESERV.	FILTERED? Y/N	NOTES

Laboratory:_____ Chain - of - Custody No.: _____

Sampler:_____ Page ___ of ___

K INFELDER

PROJECT NO.	PROJECT NAME			NO. OF CON-TAINERS	TYPE OF CON-TAINERS	ANALYSIS	RECEIVING LAB:
L.P. NO. (P.O. NO.	SAMPLERS. (Signature/Number)						INSTRUCTIONS/REMARKS
	DATE MM/DD/YY	SAMPLE I.D. TIME HH-MM-SS	SAMPLE I.D.	MATRIX			
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							

Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)

Instructions/Remarks:

Send Results To:

KLEINFELDER
2677 EAST PARLEY'S WAY
SALT LAKE CITY, UT 84109-1617
(801) 466-6769

Attn:

M-60 White – Sampler Canary – Return Copy To Shipper Pink – Lab Copy

CHAIN OF CUSTODY

№ 5842

KLEINFELDER

Daily Field Report (DFR)

Project Name _____ Project No. _____ Date _____

Project Location _____ Time Arrived _____

Contractor _____ Technician _____ Time Departed _____

Weather _____ Travel Time _____

Earthwork Equipment Observed _____ Mileage _____

DFR Given to (or left at) _____ DFR No. _____

Reviewed by _____ Date Reviewed _____

Observations/Remarks:

NOTE: Observations, pass/fail evaluations, and/or recommendations (if applicable) provided herein have not been reviewed by an engineer and, therefore, should be considered preliminary and subject to change.

_____

Kleinfelder Representative *Signature*

_____

Kleinfelder Representative *Print Name*

F-7A (9/93)